

CLAIMS

1. A substrate processing apparatus for processing a substrate while supplying a fluid to the substrate, said substrate processing apparatus comprising:

a substrate holder for holding and rotating the substrate; and

a holder suction unit for sucking the fluid from said substrate holder.

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2. A substrate processing apparatus according to claim 1, further comprising a periphery suction unit for sucking the fluid from a peripheral portion of the substrate.

3. A substrate processing apparatus according to claim 1 or 2, wherein said substrate holder is brought into contact with the substrate so as to hold and rotate the substrate by utilizing friction between said substrate holder and the substrate.

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4. A substrate processing apparatus according to claim 1, wherein said substrate holder has a clamp portion which is brought into contact with an edge portion of the substrate, and said holder suction unit is disposed closely to said clamp portion so as to suck the fluid which has adhered to said clamp portion.

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5. A substrate processing apparatus according to claim 1, wherein said holder suction unit communicates with a vacuum source.

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6. A substrate processing apparatus according to any one of claims 1 to 5, further comprising a holder cleaning unit for supplying a cleaning fluid to said substrate holder.

7. A substrate processing apparatus according to claim 6, wherein said holder suction unit is disposed at the forward of said holder cleaning unit in a rotational direction of said substrate holder.

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8. A substrate processing apparatus according to any one of claims 1 to 7, further comprising at least one gas supply nozzle having a gas supply mouth through which a drying gas is supplied to the substrate.

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9. A substrate processing apparatus according to claim 8, wherein the drying gas is supplied perpendicularly to a surface of the substrate.

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10. A substrate processing apparatus according to any one of claims 1 to 7, further comprising:

a gas supply unit having a plurality of gas supply nozzles for supplying a drying gas to a surface of the substrate held by said substrate holder;

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wherein gas supply start timings and gas supply stop timings of said gas supply nozzles are set independently.

11. A substrate processing apparatus according to any one of claims 1 to 7, further comprising:

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a gas supply unit having a plurality of gas supply nozzles for supplying a drying gas to a surface of the substrate held by said substrate holder;

wherein flow rates of the drying gas supplied from said gas supply nozzles are set independently.

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12. A substrate processing apparatus according to claim 8 or 9, wherein said gas supply nozzle is moved between a central portion and a peripheral portion of the substrate while supplying the drying gas to the substrate.

13. A substrate processing apparatus according to claim 12, wherein a movement speed of said gas supply nozzle is changed according to a relative position of said gas supply nozzle to the substrate.

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14. A substrate processing apparatus according to claim 12 or 13, wherein said gas supply nozzle is stopped supplying the drying gas before said gas supply mouth reaches an edge portion of the substrate.

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15. A substrate processing apparatus according to claim 8 or 9, wherein a flow rate of the drying gas supplied from said gas supply nozzle is controlled by changing a pressure of the drying gas to be supplied from said gas supply nozzle.

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16. A substrate processing apparatus according to claim 1, wherein the fluid is a liquid, and said holder suction unit does not suck the liquid while the liquid is supplied to the substrate so that a film of the liquid is formed over the surface of the substrate.

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17. A substrate processing apparatus according to claim 1, wherein said holder suction unit has a conductive portion made of an electrically conductive material, and said conductive portion is grounded.

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18. A substrate processing apparatus according to claim 2, wherein said periphery suction unit has a conductive portion made of an electrically conductive material, and said conductive portion is grounded.

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19. A substrate processing apparatus comprising:
a substrate holder for holding and rotating a substrate;
a first gas supply nozzle and a second gas supply nozzle
disposed above and below the substrate, respectively, for
5 supplying a gas to the substrate;

a first liquid supply nozzle and a second liquid supply
nozzle disposed above and below the substrate, respectively,
for supplying a liquid to the substrate;

a first moving mechanism for moving said first gas supply
10 nozzle and said first liquid supply nozzle from a central portion
to a peripheral portion of the substrate; and

a second moving mechanism for moving said second gas supply
nozzle and said second liquid supply nozzle from the central
portion to the peripheral portion of the substrate;

15 wherein said first liquid supply nozzle is disposed
outwardly of said first gas supply nozzle in a radial direction
of the substrate, and said second liquid supply nozzle is disposed
outwardly of said second gas supply nozzle in the radial direction
of the substrate.

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20. A substrate processing apparatus according to claim
19, further comprising:

a holder suction unit for sucking the liquid which has
adhered to said substrate holder; and

25 a periphery suction unit for sucking the liquid from the
peripheral portion of the substrate.

21. A substrate processing apparatus according to claim
19 or 20, wherein said substrate holder has a roller which is
30 brought into contact with an edge portion of the substrate, and
said roller is rotated about its own axis while keeping in contact
with the substrate.

22. A substrate processing apparatus according to any one of claims 19 to 21, wherein said first gas supply nozzle disposed above the substrate and said second gas supply nozzle disposed below the substrate reach the peripheral portion of the substrate at the same time.

23. A substrate processing apparatus according to any one of claims 19 to 22, wherein said first gas supply nozzle and said first liquid supply nozzle are moved so as to trace an arc track or a linear track extending from the central portion of the substrate, and said second gas supply nozzle and said second liquid supply nozzle are moved so as to trace an arc track or a linear track extending from the central portion of the substrate.

24. A substrate processing apparatus according to claim 20, wherein said holder suction unit has a conductive portion made of an electrically conductive material, and said conductive portion is grounded.

25. A substrate processing apparatus according to claim 20, wherein said periphery suction unit has a conductive portion made of an electrically conductive material, and said conductive portion is grounded.

26. A polishing apparatus comprising:
a polishing unit for polishing a substrate; and
a substrate processing apparatus according to any one of claims 19 to 25.

27. A plating apparatus comprising:
a plating unit for plating a substrate; and
a substrate processing apparatus according to any one of claims 19 to 25.

28. A substrate processing method comprising:
rotating a substrate by a substrate holder;
supplying a fluid to the substrate which is being rotated;
and

5 sucking the fluid, which has been moved from the substrate
to said substrate holder, through a holder suction unit disposed
closely to said substrate holder.

29. A substrate processing method according to claim 28,
10 further comprising sucking the fluid from a peripheral portion
of the substrate through a periphery suction unit disposed closely
to the peripheral portion of the substrate.

30. A substrate processing method according to claim 28
15 or 29, wherein said substrate holder is brought into contact
with an edge portion of the substrate so as to hold and rotate
the substrate.

31. A substrate processing method comprising:
20 bringing a substrate holder into contact with an edge
portion of a substrate so as to hold and rotate the substrate;
supplying a fluid to the substrate which is being rotated
by said substrate holder;

supplying a drying gas to the substrate from a gas supply
25 nozzle;

moving said gas supply nozzle from a central portion to
a peripheral portion of the substrate while supplying the drying
gas to the substrate so as to move the fluid on the substrate
to the peripheral portion of the substrate; and

30 sucking the fluid, which has been moved from the peripheral
portion of the substrate to said substrate holder, through a
holder suction unit disposed closely to said substrate holder.

32. A substrate processing method according to claim 31, further comprising:

supplying a cleaning fluid from a holder cleaning unit to said substrate holder so as to process the fluid which has
5 been moved to said substrate holder; and

sucking the fluid, which has been processed by the cleaning fluid, through said holder suction unit;

wherein said holder suction unit is disposed at the forward of said holder cleaning unit in a rotational direction of said
10 substrate holder.

33. A substrate processing method according to claim 31, wherein the fluid is a liquid, and said holder suction unit does not suck the liquid while the liquid is supplied to the substrate
15 so that a film of the liquid is formed over the surface of the substrate.

34. A substrate processing method comprising:

rotating the substrate by a substrate holder;

20 supplying a liquid from at least one of a first liquid supply nozzle and a second liquid supply nozzle disposed above and below the substrate, respectively, to a portion located radially outwardly of a central portion of the substrate;

supplying a gas from a first gas supply nozzle and a second
25 gas supply nozzle disposed above and below the substrate, respectively, to the central portion of the substrate;

moving said first liquid supply nozzle and said first gas supply nozzle from the central portion to the peripheral portion of the substrate so as to dry an upper surface of the substrate;
30 and

moving said second liquid supply nozzle and said second gas supply nozzle from the central portion to the peripheral portion of the substrate so as to dry a lower surface of the substrate.

35. A substrate processing method according to claim 34, wherein while said first and second liquid supply nozzles and said first and second gas supply nozzles are moved from the central portion to the peripheral portion of the substrate, the liquid
5 which has adhered to said substrate holder is sucked by a holder suction unit and the liquid on the peripheral portion of the substrate is sucked by a periphery suction unit.

36. A substrate processing method according to claim 34
10 or 35, wherein said first gas supply nozzle disposed above the substrate and said second gas supply nozzle disposed below the substrate are moved so as to reach the peripheral portion of the substrate at the same time.

37. A substrate processing apparatus comprising:
a substrate holder for holding and rotating a substrate;
at least one fluid supply port for supplying a fluid to
- the substrate which is being rotated; and
at least one fluid suction port for sucking the fluid on
20 the substrate;
wherein said fluid supply port and said fluid suction port are disposed closely to the substrate.

38. A substrate processing apparatus according to claim
25 37, wherein said fluid supply port and said fluid suction port are reciprocated in a radial direction of the substrate.

39. A substrate processing apparatus according to claim
37 or 38, wherein a plurality of said fluid supply ports and
30 a plurality of said fluid suction ports are disposed alternately.

40. A substrate processing apparatus according to claim
37 or 38, wherein both or either of a plurality of said fluid
supply ports or a plurality of said fluid suction ports are disposed
35 linearly.

41. A substrate processing apparatus according to claim 37 or 38, wherein a plurality of said fluid supply ports are spaced from a surface of the substrate by an equal distance.

5 42. A substrate processing apparatus according to claim 37 or 38, wherein a plurality of said fluid suction ports are spaced from a surface of the substrate by an equal distance.

10 43. A substrate processing apparatus according to any one of claims 37 to 42, wherein said substrate holder is brought into contact with the substrate so as to hold and rotate the substrate by utilizing friction between said substrate holder and the substrate.

15 44. A substrate processing apparatus according to any one of claims 37 to 43, further comprising a holder suction unit for sucking the fluid which has adhered to said substrate holder.

20 45. A substrate processing apparatus according to any one of claims 37 to 44, further comprising a holder cleaning unit for supplying a cleaning fluid to said substrate holder.

25 46. A substrate processing apparatus according to claim 37, further comprising:

a substrate processing unit having said fluid supply port and said fluid suction port;

wherein said substrate processing unit has a first operation section in which said fluid supply port and said fluid suction port are disposed.

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47. A substrate processing apparatus according to claim 46, wherein said substrate processing unit has a second operation section in which said fluid supply port and said fluid suction port are disposed.

48. A substrate processing apparatus according to claim 47, wherein said substrate processing unit is operable to switch said first operation section and said second operation section therebetween so that one of said first operation section and
5 said second operation section faces the substrate.

49. A substrate processing apparatus according to claim 37, wherein flow rates of the fluid supplied respectively from a plurality of said fluid supply ports are adjusted such that
10 the flow rates are increased gradually from a central side to a peripheral side of the substrate.

50. A substrate processing apparatus according to claim 38, wherein a period of reciprocating movement of said fluid
15 supply port and said fluid suction port is longer than a rotational period of the substrate.

51. A substrate processing apparatus according to any one of claims 37 to 50, further comprising at least one gas supply
20 nozzle having a gas supply mouth through which an inert gas or a low humidity gas is supplied to the substrate.

52. A substrate processing apparatus according to any one of claims 37 to 51, further comprising a recovery tank for reusing
25 the fluid which has been sucked and recovered through said fluid suction ports.

53. A substrate processing method, comprising:
rotating a substrate;
30 supplying a fluid from at least one fluid supply port to the substrate which is being rotated; and
sucking the fluid on the substrate through at least one fluid suction port;

wherein said fluid supply port and said fluid suction port are disposed closely to the substrate.

54. A substrate processing method according to claim 53,
5 wherein flow rates of the fluid supplied respectively from a plurality of said fluid supply ports are adjusted such that the flow rates are increased gradually from a central side to a peripheral side of the substrate.

10 55. A substrate processing method according to claim 53, wherein said fluid supply port and said fluid suction port are reciprocated in a radial direction of the substrate, and a period of reciprocating movement of said fluid supply port and said fluid suction port is longer than a rotational period of the
15 substrate.

56. A substrate holding apparatus comprising:
a plurality of rollers which are brought into contact with an edge portion of a substrate so as to hold and rotate the
20 substrate; and
at least one moving mechanism for moving said rollers;
wherein said rollers are moved in a radial direction of the substrate.

25 57. A substrate holding apparatus according to claim 56, wherein said rollers are disposed at equal intervals in a circumferential direction of the substrate.

58. A substrate holding apparatus according to claim 56
30 or 57, at least one of said rollers presses the edge portion of the substrate toward a center of the substrate while rotating the substrate.

59. A substrate holding apparatus according to any one of claims 56 to 58, wherein each of circumferential surfaces of said rollers has a groove-like clamp portion which is brought into contact with the edge portion of the substrate, and a width
5 of said clamp portion is not more than twice a thickness of the substrate.

60. A substrate holding apparatus according to claim 59, wherein said clamp portion has a flat section positioned centrally
10 in said clamp portion and two curved sections positioned adjacent to upper and lower ends of said flat section, and a width of said flat section is not more than half the thickness of the substrate.

15 61. A substrate holding apparatus according to claim 56, wherein a distance between contact points where adjacent two of said rollers are held in contact with the substrate is smaller than a diameter of the substrate.